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Prevalence of *Giardia* spp. in Beaver and Muskrat Populations in Northeastern States and Minnesota: Detection of Intestinal Trophozoites at Necropsy Provides Greater Sensitivity than Detection of Cysts in Fecal Samples

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Surveys of the prevalence of the intestinal protozoan *Giardia* spp. in animal populations have relied almost exclusively on the detection of cysts in fecal samples. We have determined the prevalence of *Giardia* spp. in beaver and muskrat populations in four northeastern states and Minnesota by using both the detection of trophozoites in mucosal scrapings from live-trapped animals at necropsy and the detection of cysts in fecal samples collected from kill-trapped animals. In muskrats the prevalence of *Giardia* infection was 36.6% by cyst detection in fecal samples (n = 790) from kill-trapped animals and 95.9% in live-trapped muskrats when the intestinal contents were analyzed for the presence of trophozoites (n = 219). Similarly, in beavers, *Giardia* infection was 9.2% by cyst detection in fecal samples (n = 662) from kill-trapped beavers and 13.7% in live-trapped animals examined for the presence of intestinal trophozoites (n = 302). The detection of trophozoites in mucosal scrapings from live-trapped animals consistently yielded a significantly higher prevalence for both muskrats and beavers than did the method based on detection of cysts in the fecal samples. The prevalence of *Giardia* infection in juvenile and adult live-trapped muskrats was similar (92.5 and 94.4%, respectively), but the prevalence in juvenile live-trapped beavers (23.2%) was significantly greater than that seen in the adult animals (12.6%). No difference in *Giardia* prevalence on the basis of sex was seen in either animal species. Regional variation, often statistically significant, was seen in the prevalence of *Giardia* in beavers in the northeastern states and Minnesota, but was not detected for muskrats.

Between 1965 and 1984, more than 90 outbreaks of waterborne giardiasis occurred in the United States. Community water systems relying on surface water treated mainly with chlorine for drinking purposes were involved in 73% of the outbreaks (3). In a number of these giardiasis outbreaks, aquatic mammals infected with *Giardia* spp. were detected in the watershed. Several reports have suggested animals such as the beaver (5, 13, 15, 29), muskrat (12), and water vole (18) as potential reservoirs for *Giardia* spp. that may be capable of infecting humans.

A number of studies have been conducted on the prevalence of *Giardia* spp. in beaver or muskrat populations or both (5, 9, 10, 12, 16, 22, 28). However, these previous studies have been limited to the detection of cysts in fecal droppings or in feces removed from the carcasses of kill-trapped animals provided by trappers. It seemed likely that the prevalence of *Giardia* infection detected in these studies, 3.4 to 18% for beavers and 0 to 70% for muskrats, may have been lower than the true rate of infection, since the shedding of cysts in feces is believed to be cyclic in several animal species, including humans (1, 4, 14, 20, 21).

In this investigation, we have determined the prevalence of *Giardia* infection in both beavers and muskrats in four northeastern states (Maine, New Hampshire, New York, and Vermont). Each of these states, except for Maine, has experienced documented waterborne outbreaks of giardiasis (2, 3, 15, 25). We also included data from Minnesota, a state with no reported outbreaks of this parasite associated with surface water contamination. The state of Massachusetts was added later when we were requested to examine a smaller number of both fecal samples and animals from Pittsfield, Mass., during the waterborne outbreak of giardiasis in 1985 (11). The presence of *Giardia* cysts was determined in fecal samples from kill-trapped animals, whereas the detection of trophozoites in intestinal scrapings was used to determine *Giardia* prevalence in live-trapped animals that had been killed and necropsied. In addition, the prevalence of *Giardia* spp. was correlated with the age and sex of the animals.

MATERIALS AND METHODS

Selection of watersheds. The natural prevalence of *Giardia* infection in both beavers and muskrats in watersheds in four northeastern states and Minnesota was investigated. Watersheds having documented waterborne outbreaks of giardiasis included Fish Creek in Rome, N.Y. (25), the Androscoggin and Ammonoosuc Rivers in Berlin, N.H. (15), and several watersheds in Vermont (2).

Trapping of beavers and muskrats. Only beavers and muskrats were investigated for their ability to support *Giardia* populations, since they were the only species of aquatic mammals previously suspected of zoonotic involvement in waterborne giardiasis outbreaks. Permission was obtained from the Fish and Game Departments (or their equivalents)

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of each northeastern state and Minnesota to live-trap up to 20 beavers and 20 muskrats per year. Live beavers were collected in the spring (May) and fall (October) with Hancock live-traps (Hancock Trap Co., Buffalo Gap, S.D.). Muskrats taken with leg-hold traps were examined as soon as possible after collection, but no more than 15 h after trapping. Since the intestinal *Giardia* trophozoites observed were viable as judged by flagellar motility, the muskrats collected by leg-hold traps were grouped with live-trapped animals for analysis. Each state Fish and Game agency helped us to identify and contact conscientious trappers to assist in both live trapping and the collection of fecal samples from the carcasses of kill-trapped beavers and muskrats taken during the trapping seasons (November to February).

Collection of fecal samples from kill-trapped beavers and muskrats. Collection of fecal samples from kill-trapped beavers and muskrats was facilitated by providing each selected trapper with a fecal collection kit consisting of wooden tongue depressors (for obtaining colonic fecal samples) and plastic specimen vials containing 2% potassium dichromate solution. This solution was used as a preservative, because it provided superior results when compared with 10% formaldehyde or 2% glutaraldehyde in preliminary tests on preservation of cyst morphology (Erlandsen and Bemrick, unpublished data). Labels were attached to each vial to enable the trapper to indicate (i) the type of animal, (ii) its approximate weight, (iii) the sex of the animal, (iv) the watershed site, and (v) the date of collection. The weight data collected were subsequently converted to indicate the approximate ages of the animals. Beavers less than 10 lb (4.5 kg), 10 to 30 lb (4.5 to 13.5 kg), and more than 30 lb (13.5 kg) were classified as kits, juveniles, and adults, respectively. The same type of system was used for muskrats, but was adjusted to fit the size of the species. Owing to the small number of kits trapped, they were excluded from statistical analysis. Muskrats less than 1 lb (0.45 kg) were considered kits or juveniles, whereas those greater than 1 lb corresponded to adults. Samples obtained by each trapper were collected and shipped to Minnesota, where the presence of cysts was determined microscopically.

Determination of *Giardia* cysts in fecal samples. When fecal samples from the field collections were received in the laboratory, they were processed for microscopic examination of *Giardia* cysts by a modification of the zinc sulfate floatation technique (8). A portion of each fecal sample was centrifuged at $1,000 \times g$, and the pellet was suspended in a 33% (by weight) solution of zinc sulfate (specific gravity, 1.180). The tubes were then centrifuged at $1,000 \times g$ for 5 min; the air-zinc sulfate meniscus was transferred carefully, on a wire loop, to a slide, and a cover slip (18 by 18 mm) was applied. The slides were examined without staining by bright-field microscopy with defocused condenser illumination at $\times 100$ total magnification for the presence of *Giardia* cysts. The identity of the cysts was confirmed by using a modification of the criteria described by Schaefer and Rice (23), including size, shape, and at least two of the following morphological cytoplasmic features: two to four nuclei, axonemes, portions of the adhesive disk, and median bodies.

Detection of *Giardia* trophozoites in intestinal scrapings. All necropsies of live-trapped beavers and muskrats were performed by the authors (S.L.E., L.A.S., and W.J.B.) on site, in each of the six states, since the trophozoite form of *Giardia* spp. was observed to survive for at least 15 h after the death of the host (Erlandsen and Bemrick, unpublished observations). All of the beavers were anesthetized by subcutaneous injections of 10 to 15 mg of ketamine hydrochloride (Bristol Laboratories, Syracuse, N.Y.) per kg of body weight plus 2.5 mg of acepromazine (Aveco Co., Fort Dodge, Iowa) per kg of body weight delivered with a pole syringe (Ideal Instruments, Chicago, Ill.). The animals were weighed on a portable scale, and euthanasia was performed by intracardiac injection of a lethal dose of pentobarbital. The animals were necropsied immediately. Each intestinal tract was freed from the mesentery, and, at approximately 3-in. (7.6-cm) intervals in the duodenum-upper jejunal segment or 6-in. (15.2-cm) intervals in the lower jejunal-ileal segment, intestinal scrapings in 0.9% sodium chloride were prepared on slides. Cover slips were applied, and these slides were examined by bright-field optics with a defocused condenser at $\times 100$ total magnification with a Cooke-McArthur Field microscope (Cooke Troughton and Simms, York, England). Motile trophozoites were easily detected by their characteristic erratic, tumbling-rotary movement. Also, colonic fecal samples were collected from each animal necropsied for use in the correlation of cyst presence with the presence or absence of intestinal trophozoites.

RESULTS

***Giardia* prevalence in muskrats: detection of fecal cysts in kill-trapped animals versus detection of intestinal trophozoites in live-trapped animals.** Fecal samples from kill-trapped muskrats were collected from winter 1985 to spring 1987 in different geographical locales in all states except Massachusetts. A total of 790 fecal samples were obtained from kill-trapped muskrats, while, during the same period, 219 live-trapped muskrats were examined for the presence of intestinal trophozoites. The results of these surveys are shown in Table 1 and demonstrate that the prevalence of *Giardia* infection was much lower when based on fecal cysts in kill-trapped animals than when intestinal contents of live-trapped animals were analyzed for trophozoites at necropsy. The overall prevalence of *Giardia* infection in kill-trapped muskrats was 36.6%. Examination of intestinal contents from live-trapped muskrats revealed that the prevalence of giardiasis was 95.9%, or more than twofold greater (significant at $P = 0.01$ by χ^2 analysis) than that detected in fecal samples from kill-trapped animals. Thus, in every state we studied, detection of intestinal trophozoites was a significantly more sensitive method for diagnosing *Giardia* infections than was the use of cyst detection in the feces. During the fall of 1986, a subset of 26 live-trapped muskrats from the northeastern states were all shown to contain intestinal trophozoites. When colonic fecal samples from these animals were analyzed for the presence of *Giardia* cysts, only 61.5% of the 26 animals were positive.

Animal weight and sex were correlated with the presence of *Giardia* only for the live-trapped animals, since more than 94% of them were infected. These results are summarized in Table 2. No difference in the prevalence of *Giardia* was detected when young animals weighing less than 1 lb were compared with animals weighing more than 1 lb or when males were compared with females.

***Giardia* prevalence in beavers: detection of cysts in fecal samples from kill-trapped animals versus detection of intestinal trophozoites in live-trapped animals.** A total of 662 samples were collected from kill-trapped beavers in the northeastern states and Minnesota, while 302 live-trapped beavers were analyzed for the presence of intestinal trophozoites (Table 3). The overall prevalence of *Giardia* infection was, as in the muskrat, higher when based on analysis of intestinal contents from live trapped animals (13.7%) than

TABLE 1. Geographical distribution of *Giardia* prevalence in muskrats

State	Determination of cysts in fecal samples[a]				Determination of trophozoites in intestine[b]			
	Total no. of animals	% Male	% Female	% Overall *Giardia* prevalence	Total no. of animals	% Male	% Female	% Overall *Giardia* prevalence
Massachusetts	NS[c]	NS	NS	NS	7	71.4	28.6	100
Maine	80	33.7	66.3	26.2[d]	30	66.6	33.4	93.3[d]
New Hampshire	229	61.5	38.5	58.5[d]	85	45.8	54.2	97.6[d]
New York	195	78.4	21.6	16.9[d]	14	42.8	57.2	85.7[d]
Vermont	177	62.1	37.9	38.9[d]	17	64.7	35.3	82.3[d]
Minnesota	109	59.6	40.4	29.3[d]	66	ND[e]	ND	100[d]
Total	790	62.7	37.3	36.6[d]	219	53.0 (n = 153)	47.0 (n = 153)	95.9[d]

[a] Samples obtained from kill-trapped muskrats.
[b] A minimum of seven samples of small intestine were examined at necropsy for each live-trapped animal.
[c] NS, No sample.
[d] Significant difference between methods of 0.01 by χ^2 analysis.
[e] ND, Not determined.

when based on analysis of fecal samples from kill-trapped animals (9.2%). This was a statistically significant difference (P = 0.05) by χ^2 analysis. A comparison of the prevalence of giardiasis in both kill-trapped and live-trapped beavers from the six different geographical locales revealed considerable variability in *Giardia* prevalence rates between individual states (Table 3), but it was observed that in each state (with the exception of Maine) the detection of *Giardia* infection in live-trapped animals was always higher than infection in kill-trapped animals by a factor of 1.1 to 3.7. The states of Maine, New Hampshire, and Minnesota had similar prevalence rates of *Giardia* infection (11.9, 8.2, and 7.0%, respectively), whereas the states of New York and Vermont had significantly higher rates (P = 0.05 for New Hampshire versus New York; P = 0.01 for New Hampshire or Minnesota versus Vermont). A subset of beavers live-trapped in New England during the fall of 1986 and shown to contain intestinal trophozoites were examined for the presence of cysts in colonic fecal samples. When these animals were analyzed for the presence of *Giardia* cysts, only 80.9% of the 21 samples examined were positive for cysts, even though all of the animals were infected as determined by the presence of intestinal trophozoites.

The relationship of the weight of the live-trapped beavers with the prevalence of *Giardia* spp. in intestinal contents is summarized in Table 4 for animals collected in the northeastern states. Approximately equal numbers of males (49.7%) and females (50.3%) were analyzed. Only four beavers weighing less than 10 lb (kits) were collected, and none were positive for *Giardia* spp. The animals collected between 10 and 30 lb represented juveniles (n = 86), and the prevalence of giardiasis in this group was 23.2%. The prevalence of *Giardia* infection in adult animals (weighing between 30 and 70 lb was 12.5% (n = 127). Juvenile beavers had a significantly higher *Giardia* infection level (P = 0.05 by χ^2 analysis) than did older beavers, but no difference in the prevalence of giardiasis with respect to sex was seen in the different age groups.

A comparison of the prevalence of *Giardia* spp. in beavers live-trapped in 1985 (18.1%; n = 121) with the prevalence in those trapped in 1986 (15.1%; n = 86) did not reveal any discernible difference. Analysis of the beavers collected during the three consecutive spring seasons (1985 to 1987) showed a *Giardia* prevalence of 12.4% (n = 89). Conversely, beavers collected in the fall seasons (1985 to 1987) had a *Giardia* prevalence of 19.5% (n = 128); however, this difference was not significant (P > 0.05) by χ^2 analysis. No apparent difference between the numbers of male and female beavers collected was seen in either annual or seasonal analysis of live-trapped beavers, nor was any apparent difference in the gender ratio seen between the trapped animals positive for *Giardia* spp. (data not shown).

TABLE 2. Prevalence of intestinal *Giardia* trophozoites in live-trapped muskrats based on weight and sex of animals

Wt range (lb)	Total no. of animals	% Male	% Female	% *Giardia* prevalence[a]		
				Male	Female	Overall
0–1[b]	27	44.4	55.6	100 (n = 12)	86.7 (n = 13)	92.5[c]
>1[d]	126	55.6	44.4	94.2 (n = 66)	94.7 (n = 53)	94.4[c]
Total	153	52.9	47.1	95.1 (n = 78)	93.0 (n = 66)	94.3

[a] Numbers in parentheses are the numbers of animals.
[b] Classified as kits or juveniles.
[c] No significant difference was detected by χ^2 analysis.
[d] Classified as adults.

DISCUSSION

In our study, comparison of cyst detection in fecal samples versus the detection of trophozoites in smears of the intestinal mucosa definitely showed that considerable variation in prevalence occurred depending upon the method of detection used. Detection of cysts in the feces of kill-trapped muskrats or beavers resulted in significantly lower estimates of *Giardia* prevalence than detection of trophozoites in intestinal contents of live-trapped animals. For example, the prevalence of *Giardia* cysts in muskrats was 36.6% based on analysis of fecal samples, but it was greater than 94% when live-trapped animals were sacrificed, necropsied, and examined for trophozoites in the intestinal contents. Similarly, the prevalence of *Giardia* cysts in beaver fecal samples (n = 302) in the northeastern states and Minnesota was 9.2% in kill-trapped animals, but the detection of trophozoites in intestinal contents of necropsied beavers from the same watersheds resulted in a prevalence of 13.7%. These results were also verified by comparing the efficacy of cyst detection in a series of selected fecal samples from animals known to be positive for *Giardia* trophozoites. This analysis showed that only 80.9% of the trophozoite-positive beavers (n = 21) were detected when fecal samples were examined for cysts,

TABLE 3. Geographical distribution of *Giardia* prevalence in beavers

State	Determination of cysts in fecal samples[a]				Determination of trophozoites in intestine[b]			
	Total no. of animals	% Male	% Female	Overall *Giardia* prevalence	Total no. of animals	% Male	% Female	% Overall *Giardia* prevalence
Massachusetts	9	ND[c]	ND	11.1	NS	NS[d]	NS	NS
Maine	138	51.5	48.5	15.9	42	52.3	47.7	11.9
New Hampshire	259	61.0	39.0	7.3	61	47.5	52.5	8.2
New York	96	69.7	30.3	10.4	46	41.3	58.7	19.5
Vermont	73	71.2	28.8	6.8[e]	68	55.9	44.1	25.0[e]
Minnesota	87	43.6	56.4	4.5	85	ND	ND	7.0
Total	662	59.1 (n = 653)	40.9	9.2[f]	302	49.8 (n = 217)	50.2	13.7[f]

[a] Samples obtained from kill-trapped beavers.
[b] A minimum of seven samples of small intestine were examined at necropsy for each live-trapped animal.
[c] ND, Not determined.
[d] NS, No sample.
[e] Significant difference between methods of 0.01 by χ^2 analysis.
[f] Significant difference between methods of 0.05 by χ^2 analysis.

whereas only 61.5% of the trophozoite-positive muskrats (n = 26) were positive for cysts. Therefore, the diagnosis of *Giardia* infection in beavers and muskrats by detection of trophozoites in intestinal mucosal scrapings is a more sensitive method than cyst detection in fecal specimens. The sensitivity of the latter method possibly could have been improved by using indirect immunofluorescence, but this technique was not available at the onset of the study. Scholtens et al. (24) have reported that the detection of cysts in avian fecal samples was more sensitive than the detection of trophozoites in mucosal scrapings. However, these authors erred in that they did not use both methods of detection on the same group of birds, but, instead, used separate groups of birds collected over different periods for each method. Thus, they had no basis for a comparative evaluation of which method was more sensitive for the diagnosis of *Giardia* infection. In our own experience in working with birds, the detection of *Giardia* cysts may be difficult in unstained specimens by bright-field or phase-contrast microscopy owing to a similarity in the refractive indices of cysts and water and to the fact that birds may not shed large numbers of cysts even when heavily infected with trophozoites (Erlandsen and Bemrick, unpublished observations).

A comparison of the prevalence of *Giardia* infection in muskrats and beavers in eight different geographical locales is presented in Table 5. The level of detection of *Giardia* trophozoites in muskrats in our study (94.1% in the northeastern and 100% in Minnesota) was substantially higher than had been reported by others for the detection of cysts in fecal samples, but was in complete agreement with a brief report by Penn (19) showing 100% of 53 muskrats in Louisiana to be infected when the intestinal mucosa was examined for trophozoites. From our experience, essentially all muskrats should be considered positive for *Giardia* spp. The presence of up to 10^5 *Giardia* cysts per g of muskrat feces (26; Erlandsen and Bemrick, unpublished data), together with the high prevalence rate, would seem to indicate that these animals could make significant contributions of *Giardia* cysts to the contamination of watersheds, assuming that the fecal material is dissolved and dispersed within the water. It has been suggested that *Giardia* cysts in muskrats could be infective for humans (12, 17, 22). In comparing *Giardia* cysts obtained from humans with those obtained from muskrats live-trapped in Minnesota and northeastern states, we have noted phenotypic differences in flagellar patterns and cyst morphology, together with different immunoreactivity patterns with antisera to the *Giardia* cyst wall (6). This has led us to conclude that muskrats were infected with a separate species, *Giardia ondatrae*, which may not be closely related to the organism that infects humans. However, we cannot totally exclude the possibility that some of these animals could have possessed other *Giardia* species or strains, but we have no evidence to support this supposition. Likewise, we have not seen any evidence of the phenotypic characteristics of *G. ondatrae* cysts (binary morphology) in *Giardia* cysts isolated from human patients; therefore, one might surmise, from this observation, that *G. ondatrae* may not be infective for humans. Further studies are needed to determine the potential for cross-species transmission of *G. ondatrae* cysts to higher primates or comparing genetic markers of *G. ondatrae* with those of *G. lamblia* must be

TABLE 4. Prevalence of intestinal *Giardia* trophozoites in live-trapped beavers from northeastern states based on weight and sex of animals

Wt range (lb)	Total no. of animals	% Male	% Female	% *Giardia* prevalence[a]		
				Male	Female	Overall
<10 (kits)	4	50	50	0	0	0
10–30 (juveniles)	86	43.1	56.9	21.6 (n = 8)	24.5 (n = 12)	23.2[b]
>30 (adults)	127	54.3	45.7	14.5 (n = 10)	10.3 (n = 6)	12.6[b]
Total	217	49.7% (n = 108)	50.3% (n = 109)	16.6% (n = 18)	16.5% (n = 18)	16.6%

[a] Numbers in parentheses are the numbers of animals.
[b] Significant difference of 0.05 by χ^2 analysis.

TABLE 5. Geographical Comparison of *Giardia* prevalence in muskrats and beavers based on available reports

Geographical location	Prevalence (%)[a] of intestinal trophozoites[b] in:		Prevalence (%)[a] of cysts in fecal samples from:		Source or reference
	Beavers	Muskrats	Beavers	Muskrats	
Northeastern states	16.6 (n = 217)	94.1 (n = 153)	9.9 (n = 566)	37.7 (n = 681)	This study
Minnesota	7.0 (n = 85)	100[c] (n = 66)	4.5 (n = 87)	29.3 (n = 109)	This study
New Jersey	ND[d]	ND	ND	70 (n = 220)	12
Colorado	ND	ND	18 (n = 244)	0 (n = 21)[e]	5
Colorado	ND	ND	42.5 (n = 1,257)[e]	83 (n = 6[e]	16
Pennsylvania	ND	ND	ND	75 (n = 4)	22
Louisiana	ND	100 (n = 53)	ND	ND	19
Washington	ND	ND	10.7 (n = 529)	42 (n = 133)	9
Alberta	ND	ND	3.4 (n = 58)	ND	28
British Columbia	ND	ND	14.7 (n = 299)	40 (n = 20)	10

[a] Numbers in parentheses are the numbers of animals.
[b] Intestinal trophozoites detected in mucosal smears at necropsy from live-trapped animals.
[c] Examination of fresh fecal samples from live-trapped muskrats maintained as a colony, or of intestinal samples at necropsy, revealed 100% infection with *Giardia* spp.
[d] ND, Not determined.
[e] In this study, the number in parentheses indicates the number of fecal specimens examined, not the number of animals.

performed before it can be determined whether this organism may be potentially infective for humans.

In our study, the prevalence of *Giardia* spp. in beavers from northeastern states (based on either fecal samples [9.9%] or intestinal contents [16.6%]) was within the range of prevalences previously reported in different geographical areas (3.4 to 42%) (Table 5). The close parallel among prevalences determined at a number of different geographical sites seems to indicate that a prevalence of less than 18% could be anticipated as a fairly accurate reflection of the actual level of infection in a beaver population. A very high prevalence (42%) in beavers has been reported by Monzingo and Hibler (16), but their methods for collection of beaver fecal samples from the bottoms of ponds may have permitted multiple sampling from the same infected animal(s), which would have tended to overestimate the actual prevalence, based upon the presence of cysts in fecal specimens.

A comparison of the *Giardia* prevalence in beavers from geographical sites in northeastern states known to have experienced waterborne outbreaks of giardiasis (2, 15, 25) with the overall prevalence observed in this study revealed an infection rate of 19.7% versus 13.7% for live-trapped animals and 10.5% versus 9.2% for fecal samples from kill-trapped animals, respectively. Although it appeared that the *Giardia* infection rate was slightly higher in watersheds that had experienced waterborne outbreaks of giardiasis, it should be noted that human usage occurred in all areas. This was extremely important, since *Giardia* spp. isolated from humans have some potential for infecting beavers and muskrats (7). Also, Suk et al. (27) reported that surface water in recreational areas with high human usage had significantly higher levels of *Giardia* cysts in the water (44.9%) than did water from areas with low recreational use (17.2%). The media-popularized term "beaver fever," used in regard to the role of these animals as a source of cysts in waterborne giardiasis, may actually be a misnomer, since human usage of the watersheds may have led to the contamination of the drinking water (6).

Conflicting reports have appeared on the relationship of *Giardia* prevalence in beavers to the age of the animals. Frost et al. (9) reported that juvenile beavers in the state of Washington were more frequently infected with *Giardia* than were adults, but this was not confirmed by Isaac-Renton et al. (10) in their investigation of *Giardia* prevalence in British Columbia, nor were any differences noted between juvenile-adult prevalence rates in Colorado (16). Using the weight of the animal as an indicator of age, it was obvious from our investigation of live-trapped animals that juvenile beavers (10 to 30 lb) had a significantly higher infection rate (23.2%; n = 86) than did older animals (12.6%; n = 127). It was not possible to derive any conclusions about *Giardia* prevalence in kits, since only a limited number (n = 4) were examined, but it is interesting that none of these were infected.

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